

BULLETIN

OF THE INSTITUTE OF METALS

VOLUME 5

JUNE 1961

PART 22

INSTITUTE NEWS

Autumn Meeting, Brussels, 18-23 September

As previously announced, the 1961 Autumn Meeting will be held in Brussels from Monday to Saturday, 18-23 September, by invitation of the Union des Industries de Métaux Non-Ferreux.

An outline of the programme is given below. A detailed programme will be sent later to all members resident in Europe.

Monday, 18 September

- Morning. Registration of members and guests.
Official welcome by Burgomaster, hosts, and university.
Autumn Lecture.
- Afternoon. Visits to works in Brussels region and tour of city.
- 6.0 p.m. Cocktail party at Metropole Hotel (lounge suits).

Tuesday, 19 September

- 9.30 a.m.-12.0 noon Two Simultaneous Scientific Sessions for the discussion of papers published in the *Journal*, or otherwise, in advance of the meeting:
- (a) Papers on *Aqueous Corrosion*.
 - (b) Papers on *Surface Friction and Lubrication in Metal Working*.
- Afternoon. Visits in Brussels region for members and ladies.
- 8.0 p.m. Concert at Broadcasting Station.

Wednesday, 20 September

- All day. Visits to:
- (a) Baelen and Molle.
 - (b) Liège.
 - (c) Bruges (for ladies).
- 9.0 p.m. Reception by Burgomaster at Hôtel de Ville (dinner jackets).

Thursday, 21 September

- 9.30 a.m.-12.0 noon Two Simultaneous Scientific Sessions for the discussion of papers published in the *Journal*, or otherwise, in advance of the meeting.
- (a) Papers on *Deformation and Fracture*.
 - (b) Papers on *Cobalt*.
- Afternoon. Short visits for members.
- 7.30 for 8.0 p.m. Banquet (dinner jackets).

Friday, 22 September

- All day. Visits for members and ladies in Antwerp and possibly also (for members) in Charleroi.
- 7.30 p.m. Council dinner to hosts.

Saturday, 23 September

- All day. Optional excursion.

Hotel Accommodation

Travel and hotel arrangements are being made by Thos. Cook and Son, Ltd., Post Order Department, Berkeley Street, London, W.1, who have made reservations so that the majority of those attending the meeting may stay at the same hotel (Metropole) if they so desire. Members intending to take part in the meeting are advised to make their reservations with Cook's as soon as possible.

Election of Members

The following 18 Ordinary Members, 5 Junior Members, and 9 Student Members were elected on 25 April 1961:

As Ordinary Members

- BURGHOFF, Henry Lewis, M.S., D.Eng., Director, Research and Development, Chase Brass and Copper Co., Waterbury, Conn., U.S.A.
- CARPENTER, Frederick Donald, B.Sc., Research Staff Member, General Atomic Division, General Dynamics Corp., San Diego, Calif., U.S.A.
- COLLINSON, John William, Technical Director, Sorensen Industries, Inc., Darby, Pa., U.S.A.
- COX, Edwin III, B.S., M.Ch.E., Partner, Cox and Gillespie, Richmond, Va., U.S.A.
- FALCK, Henrik Gustaf, Ing., Chief, Metal Development Department, Finska Kabelfabriken AB, Helsingfors, Sweden.
- GALVEZ, Matthew Joseph, B.S., M.M.E., Supervisor, Metallurgical Process Development Laboratory, Knolls Atomic Power Laboratory, General Electric Co., Schenectady, N.Y., U.S.A.
- GRANIER, *Ingenieur Principal du Génie Maritime* Maurice, Ing., M.S., Chef du Service Métallurgie, Laboratoire de Métallurgie, Etablissement de la Marine, Indret (Loire Atlantique), France.
- HAYES, Dennis, B.Sc.(Eng.), A.I.M., Development Engineer, Sales Development Division, Alcan Industries, Ltd., Banbury.

- HÖKBY, Bengt, Civiling., Teknisk Direktör, AB Svenska Metallverken, Västerås, Sweden.
- JESPERSON, W. H., M.Sc., Chief Metallurgist, Copper and Copper Alloys, AB Nordiske Kabel- og Traad-fabriker, Copenhagen, Denmark.
- McKAY, Andrew Melville, M.Eng., Ph.D., A.M.I.Mech.E., Chief Engineer and Director, Imperial Chemical Industries, Ltd., Billingham Division, Billingham, Co. Durham.
- MARBOT, D. Rene, Dott., Direttore, Centro Italiano Sviluppo e Applicazioni del Rame (C.I.S.A.R.), Milano, Italy.
- PRASANNA, Ghosh Supriy, B.Sc., B.Ch.E., Chemical Engineer, Silver Refinery, Calcutta, India.
- RIDLEY, John, B.Sc.(Eng.), A.I.M., Metallurgist, Alcan Industries, Ltd., Rogerstone, Mon.
- SPENCER, Chester Wallace, M.S., Ph.D., Associate Professor of Metallurgy, Cornell University, Ithaca, N.Y., U.S.A.
- SPICER, Frank, Managing Director, Roundhay Metal Finishers (Leeds), Ltd., Leeds.
- STEPHENSON, Thomas William Valentine, B.A., Development Engineer, Alcan Industries, Ltd., Sales Development Division, Banbury.
- WEISS, Volker, M.S., Ph.D., Associate Professor of Metallurgy, Syracuse University, Syracuse, N.Y., U.S.A.

As Junior Members

- GAYTON, Frederick Maurice, B.Sc., Investigator, Research Laboratories, The British Aluminium Co., Ltd., Gerrards Cross, Bucks.
- SHORT, Edward Percival, Metallurgist, Alcan Industries, Ltd., Banbury.
- STOBBS, John Jeffrey, B.Sc., Research Officer, Berkeley Nuclear Laboratories, Materials Division, Central Electricity Generating Board, Berkeley, Glos.
- STREET, Derek John, B.Met., Plant Metallurgist, Extrusion Department, Alcan Industries, Ltd., Banbury.
- TOMLIN, John Edward, B.Sc., A.C.T.(Birm.), A.I.M., Metallurgist, Allmänna Svenska Elektriska AB (ASEA), Västerås, Sweden.

As Student Members

- BAILEY, John Albert, B.Sc., Postgraduate Research Student, University College of Swansea.
- BUTRYMOWICZ, Daniel Bernard, B.S., Graduate Student, Department of Chemical and Metallurgical Engineering, University of Cincinnati, Cincinnati, Ohio, U.S.A.
- ELKUM, Alf Kenneth, B.S., Graduate Student, Department of Mineral Technology, University of California, Berkeley, Calif., U.S.A.
- FERGUSON, William Howard, Jr., S.B., Graduate Student, Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass., U.S.A.
- ROBLIN, Murray John Kenneth, B.A.Sc., Research Fellow, Department of Metallurgy, Rensselaer Polytechnic Institute, Troy, N.Y., U.S.A.
- SINGH, Ran Vijay, B.Sc., Department of Metallurgy, University of Sheffield.
- TOWNSHEND, Ronald John, Production Metallurgist, Alcan-Enfield Alloys, Ltd., London Colney, Herts.
- VOLLER, Morton David, Undergraduate, Department of Metallurgy, University of Cambridge.
- YONG-SHAN AUSTIN CHANG, M.S., Graduate Student, Department of Metallurgy, University of California, Berkeley, Calif., U.S.A.

PERSONAL NOTES

MR. WILLIAM BARR, Director and Chief Metallurgist, Colvilles Ltd., has been awarded the Bessemer Gold Medal for 1961 by The Iron and Steel Institute.

Ing, A. W. J. VAN DEN BERGH has left N.V. Kromhout Motorenfabriek, Amsterdam, and is now Technical Director of N.V. De Vuurslag Machine- en Ovenbouw, Roosendaal, Netherlands.

DR. HOWARD BIRS, Senior Consultant, The Union Carbide International Company, has been elected an Honorary Vice-President of The Iron and Steel Institute.

MR. A. H. COLLEY is now assistant metallurgist with Avesta S.A. (Pty.), Ltd., Johannesburg.

DR. H. P. CROFT has been appointed Vice-President—Research of Copper Range Company, New York.

MR. ST. JOHN DE H. ELSTUB has been appointed Chairman of Imperial Chemical Industries, Ltd., Metals Division, in succession to Mr. M. J. S. Clapham, who has joined the main board of the Company.

MR. R. C. GIFFKINS, of the Physical Metallurgy Section, C.S.I.R.O., Australia, has been awarded the degree of D.Sc. of the University of Melbourne in recognition of his researches in the field of metal deformation. He is also the recipient of the 1960 Major Furnace award of the Sydney Branch of the Australian Institute of Metals.

MR. H. GRIFFITHS is now with Deloro Stellite, Ltd., Stratton St. Margaret, Wilts.

MR. H. W. G. HIGNETT has been appointed a director of the International Nickel Co. (Mond), Ltd. He will continue as Managing Director of Henry Wiggin and Co., Ltd.

PROFESSOR R. W. K. HONEYCOMBE, Professor of Physical Metallurgy in the University of Sheffield, has been awarded the degree of D.Sc. of the University of Melbourne in recognition of his researches in the fields of plastic deformation, alloy steels, bearing alloys, &c.

PROFESSOR R. P. JERATH has left Birla College of Engineering and is now at the Regional Engineering College, Naseembagh, Srinagar, Kashmir.

MR. W. K. JOHNSON has been transferred from Aluminium Laboratories, Ltd., to the Sales Development Division of Alcan Industries, Ltd., Banbury.

MR. W. J. D. JONES is now at the Department of Mechanical Engineering, University College, London.

PROFESSOR W. R. D. JONES is to retire from the Chair of Metallurgy and Fuel Technology at the University College of South Wales and Monmouthshire, Cardiff, at the end of the present academic session. He is succeeded by Dr. H. K. M. Lloyd, senior lecturer in metallurgy at the University of Nottingham.

DR. E. LAHTENKORVA has left Oy Vuoksenniska AB, Imatra, and is now senior physicist in the Wihuri Physical Laboratory of the University of Turku, Finland.

MR. E. B. MILLWARD is now at the works of Dowty Group, Ltd., Cheltenham.

DR. T. PYLE has taken up a post with the English Electric Co., Ltd., Accrington.

MR. H. SCHWARTZBART has been appointed Assistant Director of Metals Research at the Armour Research Foundation of the Illinois Institute of Technology, Chicago.

PROFESSOR CYRIL STANLEY SMITH has left the University of Chicago, where he has been Professor of Metallurgy since 1946 and where he was the first Director of the Institute for the Study of Metals, to accept an appointment as Institute Professor at the Massachusetts Institute of Technology. He expects to divide his time between further research on the structure of polycrystalline materials and the cultivation of the history of technology and science and their interaction.

MR. P. J. SUKOLSKI has been transferred from McKechnie Bros., Ltd., to McKechnie Bros. (N.Z.), Ltd., New Plymouth, New Zealand.

MR. F. W. TOMLINSON has been appointed Deputy Chairman of Murex, Ltd., and Murex Welding Processes, Ltd.

DR. G. K. WILLIAMSON resigned his appointment at Harwell in July 1959 to take up an appointment with the Central Electricity Generating Board. After a period in the Department of Metallurgy at Cambridge, he has now moved to the Berkeley Nuclear Laboratories, Berkeley, Glos.

DR. H. ZOLLER has left the Star Aluminium Co., Ltd., Wolverhampton, and is now at Aluminium Industrie A.G., Chippis, Switzerland.

Deaths

The Editor regrets to announce the death of:

Professor CECIL WILLIAM DANNATT, Emeritus Professor of Metallurgy at Imperial College of Science and Technology, London.

Mr. ERNEST EDGAR THUM, Editor-in-Chief of *Metal Progress*.

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LETTER TO THE EDITOR

The Corrosion of Aluminium Alloys in High-Pressure Steam

In a recent paper¹ we attributed certain effects in the corrosion of aluminium to the "wetness" of the steam, suggesting that this quality was due to a non-equilibrium condition in which water droplets persisted for appreciable times in nominally dry steam. Since this suggestion was rather speculative, we think it useful to refer to a subsequent publication² which presents more definite evidence for such long-lived water droplets in superheated steam.

J. N. WANKLYN
N. J. M. WILKINS

*Metallurgy Division,
Atomic Energy Research Establishment,
Harwell, Berks.*

1. J. N. Wanklyn and N. J. M. Wilkins, *J. Inst. Metals*, 1960-61, **89**, 289.
2. J. D. Parker and R. J. Grosh, *U.S. Atomic Energy Commission Publ.*, 1961, (**ANL 6291**), pp. 77, 147.

POWDER METALLURGY JOINT GROUP

Future Activities

At forthcoming meetings of the Powder Metallurgy Joint Group the principal subjects for discussion will be:

- Winter 1961: "Sintered High-Temperature Oxidation-Resistant Materials."
- Spring 1962: "Sintered Low-Alloy Steel Engineering Components."
- Winter 1962: "Non-Metallic Dispersions in Powder Metallurgy."

Persons wishing to offer papers for any of these meetings should write to the Secretary of the Joint Group, 17 Belgrave Square, London, S.W.1.

LECTURES TO LOCAL SECTIONS AND ASSOCIATED SOCIETIES

Creep Deformation

At a joint meeting of the Liverpool Metallurgical Society with the Iron and Steel Institute on 9 March, Dr. D. McLEAN

(National Physical Laboratory) lectured on "Creep Deformation".

Creep deformation in pure metals was first discussed; in particular, the way in which creep rate depends on stress. By means of the electron microscope, it is now possible to measure how the two components of the creep rate, namely the dislocation density and the dislocation speed, are separately affected by stress, and the results of some experiments of this nature were described. Dr. McLean said that an interesting point was that during steady-state creep, when the mechanical strength of the metal remained constant, the three-dimensional network of dislocations did not alter in density, though the sub-boundary networks of dislocation grew more dense; this seemed to connect strength with the former rather than the latter. A theoretical estimate of the relation between strength and density of the three-dimensional network agreed with the experimental relation. R. W. Bailey's old idea of a balance between strain-hardening and recovery applied to these dislocations; during steady-state creep, dislocations were made by strain and destroyed by recovery at exactly equal rates.

Some strength factors in precipitation-hardened alloys were next discussed. In such alloys there seemed everything to be said for a low dislocation density, as the strength derived from the precipitate and each dislocation contributed to the creep rate; this suggested that at a suitable stage a high-temperature anneal should be given. During thermal cycling precipitates might generate dislocations, each of which presumably contributed its quota to the creep rate. Grain-boundary sliding also contributed to the creep strain, but experimental evidence indicated that hardening the grain automatically reduced sliding. A far more serious consequence of sliding was grain-boundary fracture, and the structural features required to mitigate this were discussed.

Creep was one of the fields in which it was possible to suggest guiding ideas for the design of new alloys of sufficient precision to be useful. There were, unfortunately, great difficulties about applying such ideas. The biggest difficulty was that there were so few connections between the knowledge of people working on the scientific side and that of those on the practical side, that neither side really understood the other. Serious attempts would have to be made to bridge the gap.

The Metallurgy of the Steam Turbine

Dr. L. E. BENSON (AEI (Manchester) Ltd.) gave a lecture on "The Metallurgy of the Steam Turbine" to the East Midlands Metallurgical Society on 9 March, 1961.

The lecture dealt with important materials of construction used in the manufacture of steam turbines from about 1922 to the present day. Some account was given of interesting developments in the manufacture and testing of important forgings and castings, and it was shown how the twentyfold increase in capacity of turbo-generators, which had occurred in this period, had necessitated development work in order to provide components, such as rotor forgings, not only larger in size, but also of improved mechanical properties and of superior quality at the same time.

The increase in turbine inlet steam temperature had also necessitated the progressive development of improved creep-resistant and oxidation-resistant materials. Important developments in this field were the introduction of the class of steels containing about $\frac{1}{2}\%$ molybdenum in 1925-30 and the discovery of the beneficial effect of a further addition of vanadium, leading to the development of the Mo-V-type

steels, with or without chromium, some ten years later. Simultaneously, there has been important advances in the technique of creep testing, in the formulation of creep criteria appropriate to the different conditions of service applying to different components, and in our understanding of the metallographic and other conceptions which explain the behaviour of materials with good creep characteristics. It was indicated how in all these fields Great Britain had played a notable part.

The construction of a modern steam turbine and some of its metallurgically interesting components were described and this led up to an indication of some of the considerations that are involved in raising steam inlet temperatures from 1050 to 1100° F, as is happening in Britain today, and the considerations involved in going to still higher temperatures.

Progress in the Electron Theory of Metals

At a meeting of the London Local Section on 2 March 1961, Dr. J. A. CATTERALL (National Physical Laboratory) gave a lecture on "Progress in the Electron Theory of Metals".

The historical development of the electron theory of metals was briefly outlined, together with the main features of the theory leading to the concept of energy bands, zone structure, the density-of-states curve, and the Fermi surface. Some of the older-established experiments which had been carried out to test the models of electronic structure, such as the electronic specific heat, the soft X-ray emission spectra, the magnetic susceptibility, and the electronic and galvanomagnetic properties, were described, together with their advantages and disadvantages, and the results obtained for the monovalent metals.

The more recent work on the Fermi surface in pure metals, notably copper, silver, and gold, carried out at Cambridge was outlined, and the implication of this work for the theory of the α -phase boundaries developed by Hume-Rothery and Jones was discussed. Mention was made of a more recent theory by Cohen and Heine, in which the shape of the Fermi surface could change on alloying, that had been proposed to overcome difficulties with the earlier model; mention was also made of a still more recent suggestion by Hume-Rothery, in which the second peak in the face-centred-cubic density-of-states curve was the significant feature of the α -phase boundaries, that had been put forward to overcome difficulties encountered with Cohen and Heine's model.

The standard treatment of the transition metals of the First Long Period was outlined and also its application to the magnetic, electrical, and thermal properties of these metals. The X-ray scattering work by Weiss, which revealed differences between the electronic structures of iron and cobalt, and which led to the theories of Mott and Stevens and of Lomer and Marshall, was described. More recent experimental work on X-ray scattering by Battermann, polarized-neutron data by Nathan *et al.*, specific-heat work by Cheng *et al.*, and calculations by Callaway and Edwards were shown to have led to a somewhat fluid situation regarding the theory of the transition metals.

OTHER NEWS

Remuneration of Metallurgists

The Institution of Metallurgists has recently published the results of its latest survey of the remuneration of Fellows,

Associates, and Licentiates resident in the United Kingdom. Copies of "Remuneration Survey, 1960" may be obtained from the Institution, 4 Grosvenor Gardens, London, S.W.1, price 3s., post free.

Symposium on "Very High-Purity Materials in Science and Technology"

An international symposium on "Very High-Purity Materials in Science and Technology" is to be held in Dresden on 30 November–2 December, 1961, under the auspices of the Chemische Gesellschaft in der Deutschen Demokratischen Republik, Gesellschaft Deutscher Berg- und Hüttenleute, and the Physikalische Gesellschaft in der Deutschen Demokratischen Republik. Sessions will be devoted to the production, properties, analysis, and applications of high-purity materials.

Further information can be obtained from the Chemische Gesellschaft in der DDR, Unter den Linden 68/70, Berlin, W.8.

Conference on Engineering Inspection and Non-Destructive Testing

A National Conference dealing with Engineering Inspection and Non-Destructive Testing will be held at Oxford in September 1961, to discuss the function of management in relation to inspection, the economics of inspection and non-destructive testing, and the recruitment, education, and training of inspection staffs.

This conference is being planned at the request of the Joint Committee of Materials and their Testing and the British National Committee for Non-Destructive Testing. It is being organized jointly by the Institution of Engineering Inspection and the Society of Non-Destructive Examination. The speakers invited are all closely associated with their subjects and have wide experience in the fields concerned. Sessions will be arranged to allow ample time for discussion.

In view of the wide interest already expressed by industry, learned societies, and the teaching profession, residential accommodation at Queen's College and New College, Oxford, has been reserved over the period 5–8 September 1961. The total cost, including Conference fee, accommodation, and all meals in College, will be £9 10s. od. per delegate.

Those who wish to have further information should write to the Oxford Conference Secretariat, The Institution of Engineering Inspection, 616 Grand Buildings, Trafalgar Square, London, W.C.2.

International Conference on Heavy Forging

The Camera di Commercio, Industria e Agricoltura di Terni, in conjunction with the Associazione Italiana di Metallurgia, is organizing an international conference on heavy forging to be held in Terni on 26–29 September 1961. The theme of the conference will be "Problems in the Making and Quality Aspects of Heavy Forgings."

The registration fee for the conference will be 5000 lire. Applications to take part should be sent before 15 August to the Segreteria del Convegno Italiano della Grossa Fucinatura, c/o Camera di Commercio, Industria e Agricoltura, Largo Don Minzoni 6, Terni, Italy.

APPOINTMENTS VACANT

LANCHESTER COLLEGE OF TECHNOLOGY, COVENTRY

Principal:

A. J. Richmond, B.Sc.(Eng.), Ph.D., M.I.Mech.E.

SANDWICH COURSE IN METALLURGY

Applications are invited for admission to a THREE-YEAR Sandwich Course leading to the Higher National Diploma in Metallurgy and Licentiatehip of the Institute of Metallurgists. Candidates should possess, or expect to obtain before September 1961:

- (a) An Ordinary National Certificate in Chemistry or Metallurgy of sufficient merit;
- (b) G.C.E. passes in English Language, Chemistry, Physics, Mathematics and one further non-science subject, of which either Chemistry or Physics or Mathematics must be at Advanced Level.

Industrial training is an integral part of the course for which both Works-based students and College-based students may be accepted. In the latter case, the College will be responsible for arranging industrial training, with pay, for suitably qualified applicants who can apply for a Local Authority award to cover the cost of maintenance and tuition during the periods of full-time study.

Full particulars of the course may be obtained from the Head of the Department of Chemistry, Metallurgy, and Textiles.

YOUNG GRADUATE—age not exceeding 30 years—required as assistant to the Managing Director of a small private company engaged in the production of fine wire in numerous specialized alloys. The work will be mainly technical and will carry the ultimate prospect of a directorship. The company is situated 15 miles S.W. of Birmingham. Box No. 462, The Institute of Metals, 17 Belgrave Square, London, S.W.1.

LOUGHBOROUGH COLLEGE OF TECHNOLOGY

Applications are invited for a post of LECTURER IN METALLURGY. Applicants should be well qualified academically and professionally and, preferably, have had experience both of research and of industry.

Salary according to the Burnham scale, £1370 × £35 to £1550 per annum. Further particulars and application form may be obtained from the Academic Registrar. (In reply please quote ref. 10/AK.)

SOUTH-EAST ESSEX TECHNICAL COLLEGE

Longbridge Road, Dagenham

Required September, 1961:

ASSISTANT LECTURER (Grade "B") in METALLURGY. Applicants should have a degree or equivalent qualification, with teaching experience, and be able to teach to Higher National Certificate standard. Industrial experience is also desirable.

Salary scale: £700 × £27 10s. 0d.—£1150 per annum, plus London Allowance (£38 or £51).

In assessing the commencing salary, increments above the scale minimum will be allowed for approved teaching, research, or industrial experience and national service. Additions to the salary scale will also be allowed for approved training and qualifications if in accordance with Burnham Further Education Report.

Application form and further particulars from the Clerk to the Governors.

BATTERSEA COLLEGE OF TECHNOLOGY

(A College of Advanced Technology)

Crystallography Section

A postgraduate course leading to the examinations for the degree of M.Sc. in Crystallography of the University of London or the Postgraduate Diploma of the College (D.C.T. (Batt.)), will begin on 2 October, 1961. Full-time or part-time students are accommodated, and in certain circumstances scholarships are available. For further details apply to Dr. D. Lewis, Head of the Crystallography Section, Battersea College of Technology, Battersea Park Road, London, S.W.11.

UNIVERSITY OF CAMBRIDGE DEPARTMENT OF PHYSICS

CAVENDISH LABORATORY

RESEARCH ASSISTANT is required for work in the metal physics group under the direction of Dr. P. B. Hirsch. Applicants should have some knowledge of metallurgical techniques. A University degree is not an essential qualification. Applications should be submitted to the Secretary to the Department of Physics, Cavendish Laboratory, Free School Lane, Cambridge, by not later than 15 July, 1961. The names of two referees who have a recent knowledge of the candidate's work should be given. Salary in the range £750-£1000 to be fixed in accordance with age and experience.